THERMAL PRINTER COMPONENTS

CMDT/RMDT
12V MINI-PRINTER PREMIUM SERIES
60 mm PRINTER MECHANISM

USER MANUAL

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EVOLUTIONS

Date	Issue	Modifications
10/2008	Z	Creation
03/2009	A	Modification of chapter: “Recommendations for paper”
09/2009	B	Addition of RM Version for high grammage paper
02/2010	C	Add recommendation about ESD discharge
02/2010	D	Addition of recommendations concerning the opening of the mechanism

IMPORTANT

This manual contains the basic operations for running your printer.

Read it carefully before using your printer.

Pay special attention to the chapter "Recommendations".

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1 UNPACKING

Each printer mechanism is packaged in an antistatic bag.
Observe precautions while handling in electrostatic protected areas.

2 OVERVIEW

Based on static thermal printing technology, the RM series is a family of user-friendly, highly reliable devices which have been specially designed to fit in minimum space.

CMxx: Printer only or printer with optional tear bar cover.
RMxx: Printer with robust guillotine cutter.

Characteristics:
Very small size printer and cutter
Silent mechanism
Option of 4 dots/mm or 8 dots/mm print-heads
Easy to connect (only one connector for motor, print head, opto-sensor and cutter)
Front and bottom paper introduction possible

SUMMARY OF PRINTER SPECIFICATIONS

ITEM	VALUE	UNITS
Printing method	Static thermal dot line printing	-
Printing width	56	mm
Printing speed max	150 (1)	mm/sec
Paper loading	Auto-load	-
Paper width	60	mm
Paper empty detection	By opto-sensor	-
Maximum paper thickness	80	µ
Recommended paper	JUJO AF50KSE3	
Number of resistor dots	448	-
Resolution	8	dots/mm
Number of steps / dot line	1	-
Paper feed / dot line	0.125	mm
Head temperature detection	By Thermistor	-
Out of paper detection	Opto-sensor	-
Maximum duty cycle (*to avoid motor temperature rise*)	25% max at 25°C 22 % max at 50°C (see chapter Printing recommendations)	%

SUMMARY OF PRINTER SPECIFICATIONS (continued)

ITEM		VALUE			UNITS
Storage temperature range		- 30 to + 70			℃
Operating temperature range		- 20 to + 60			℃
Relative humidity range (*operating*)		20 to 85 *no condensing*			%
Operating voltage range Vcc (*logic*)		4.5 – 5.5			V DC
Operating voltage range Vch (*dot*)		11 – 15.2			V DC
Peak print head current (*all dots "on" at nominal value*)		17.9			A
Current consumption: V ch (*at nominal value*)		35.5 mA			mA per resistor dot ”On ”
Current consumption: V cc (*at nominal value*)		100			µA
Current consumption: stepping motor for paper feed		515			mA
Current consumption: stepping motor for cutter		715			mA
Electrical life time (2)		10E8			pulses
Mechanical life time (2)		100 Km			Km
Cutter life time (for RMxx)		1 000 000 cuts with recommended paper			-
Over all dimensions:	Height	32 (CM)	36 (CM w/cover)	42.1 (RM)	mm
	Width	74.5 (CM)		74.5 (RM)	mm
	Depth	61 (CM)	62.5 (CM w/cover)	65.75 (RM)	mm
Weight (*average*) (*without paper roll*)		140 (CM)		250 (RM)	g

(1) Max print speed will depend on paper reference, power supply and dots ON ratio.

3 MECHANICAL SPECIFICATIONS

3.1 General description

The mechanism consists in:

- Plastic chassis
- Robust guillotine cutter (with relevant motor and switch) for RM versions
- Stepping motor
- Gear train
- Print head
- End of paper opto-sensor

3.2 Dimensions of the complete mechanism

Height:.....	32 (CM) / 36 (CM with cover) / 42.1 mm (RM)
Depth:.....	61 (CM) / 62.5 (CM with cover) / 65.75 mm (RM)
Width (without rewinder option)	74.5 (CM) / 74.5 mm (RM)
Weight:.....	140 (CM) / 250 g (RM)

3.3 Mechanical views

Fig. 1 CM without cover dimensions

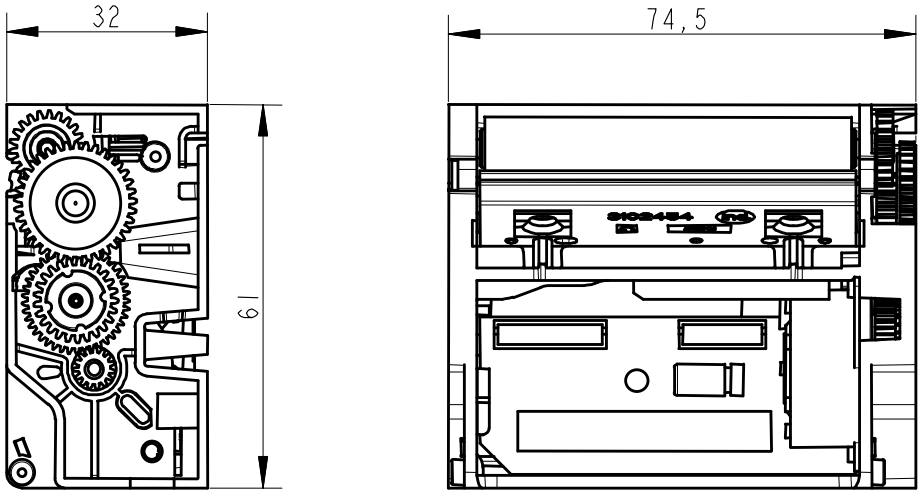


Fig. 2 CM with cover dimensions

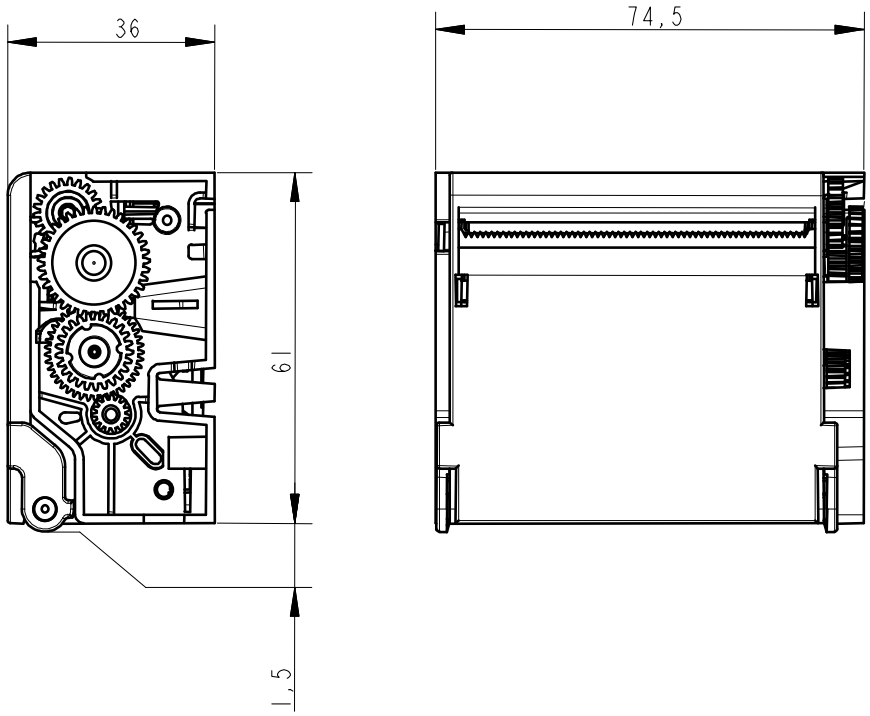


Fig. 3 Side view with cover

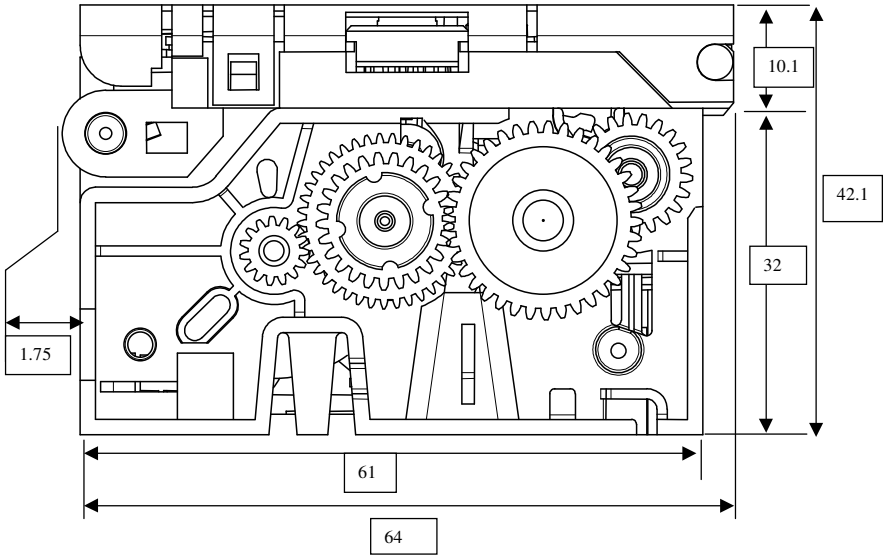


Fig. 4 front view with cover

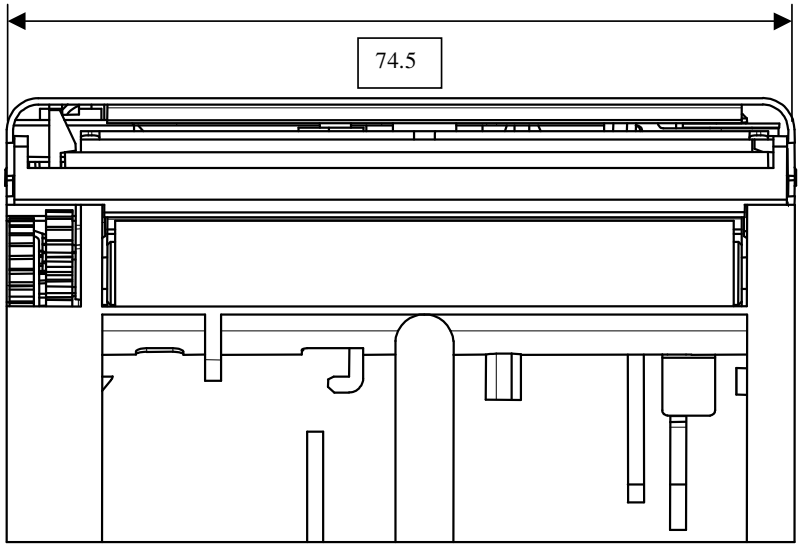
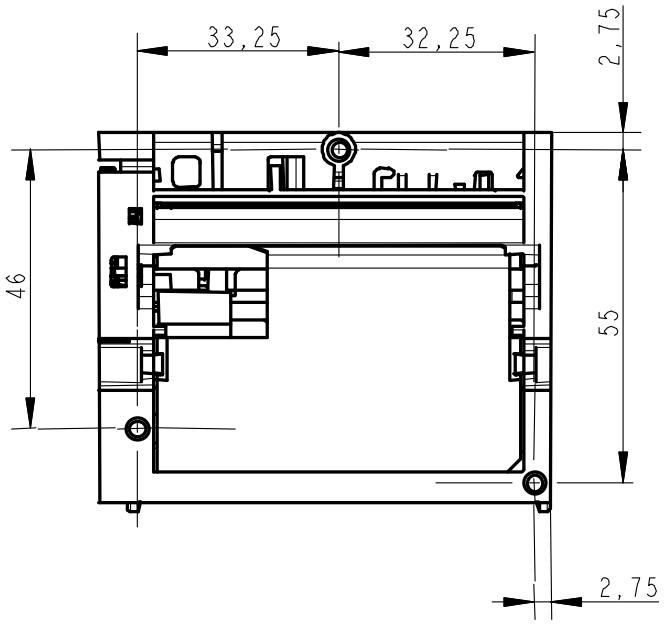


Fig. 5 bottom view / fixing holes



Use self-threader screws for plastic, the fixing holes diameter being 2.5 mm, use a maximum diameter
of 3 mm for screws and a maximum depth in chassis of 7 mm (from the external edge of holes).

Fig. 4 cutter top view

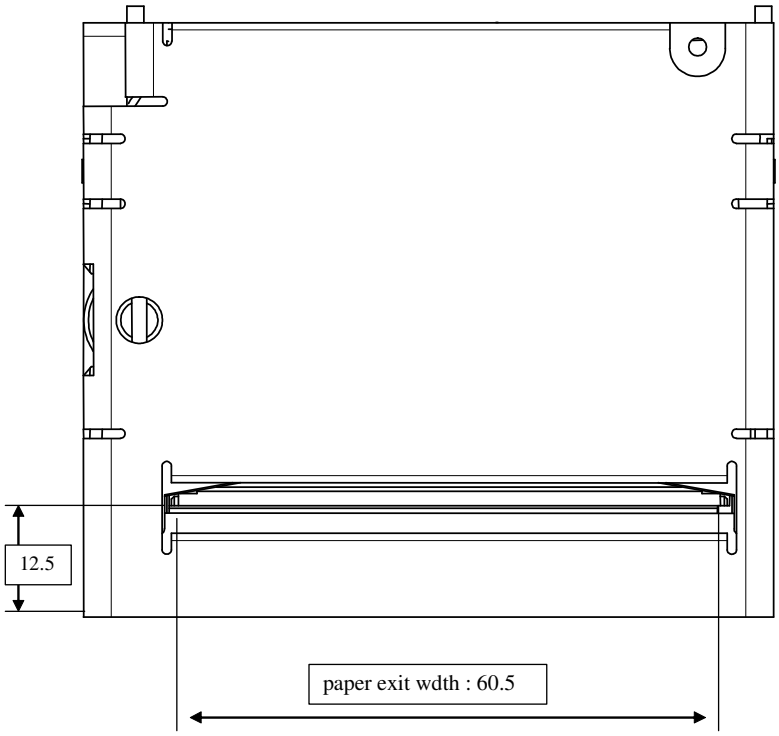
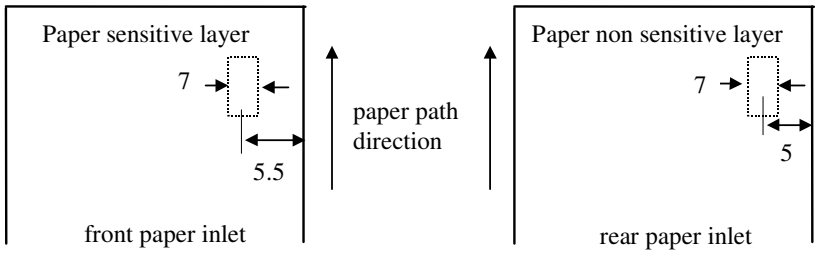


Fig. 5 Opto- sensor position

The position of the end of paper opto-sensor relatively to the paper allows top off form detection

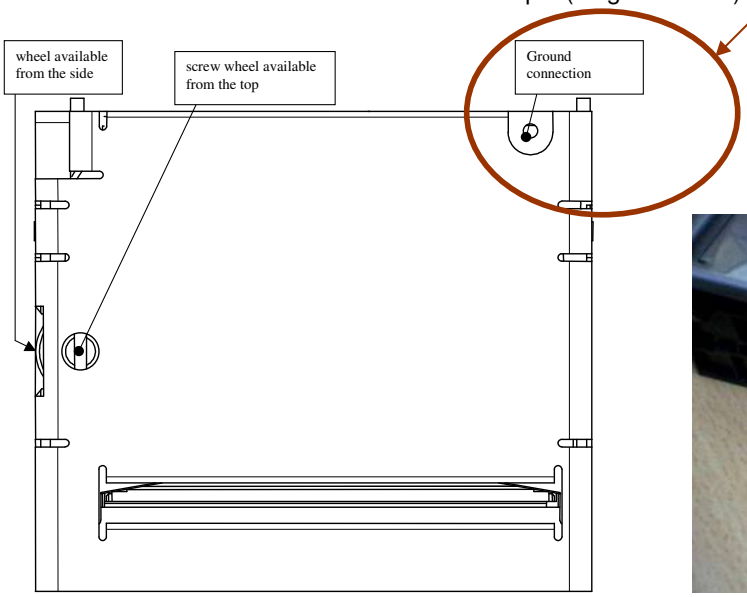


4 ELECTRICAL SPECIFICATIONS

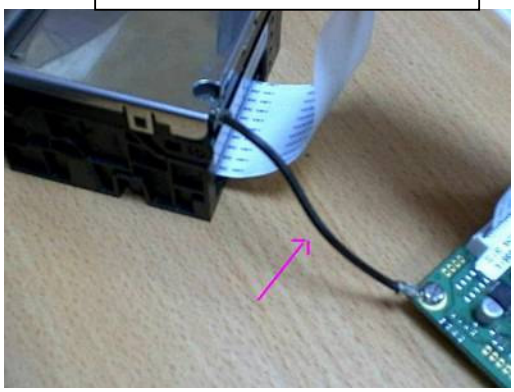
4.1 ESD discharge recommendation

Due to high speed printing, it's very important to connect the mechanism at the ground
To avoid ESD discharge which may damage the controller Board!

You can use an Axiohm KIT A3105306 for example (length 160mm)



Example of connection with CompactII board



4.2 Nominal Power supply

	Value	Units
Print head:		
Logic (Vcc)	**5**	**V DC**
Dot line	**12**	**V DC**
Stepping motor	**12**	**V DC**

4.3 Nominal Consumption

	RMDV	Units
Print head: **Heating** **current / dot** **(Vch) at nominal values**	**40**	**mA**
Logic current / dot (Vcc)	**100**	**µA**
Stepping Motor (*2 activated phases*) for paper feed	**515**	**mA**
Stepping Motor (*2 activated phases*) for versions with cutter (RMxx)	**900**	**mA**
Maximum instantaneous current per dot line (*at* 12V)	**17.9**	**A**

4.4 Description of print head

	Value	UNIT
Driver chips (64 bit BiCMos LSI)	7	-
Nominal dot resistance	300 (± 5 %)	ohms
Nominal dot energy (*in standard conditions*)	0.17	mJ/dot
Max printing speed (with 12V power supply) (*with dot historical control*)	150	mm/sec

4.4.1 Function of each 64 bit IC (integrated circuit)

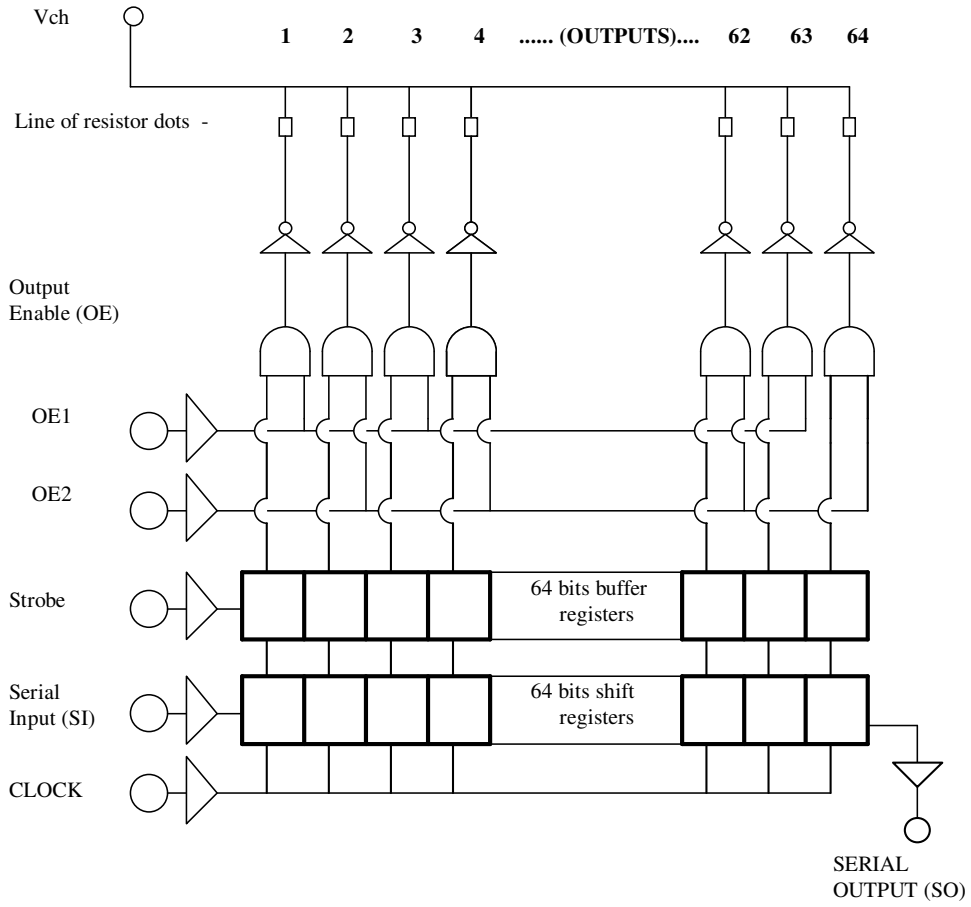


Fig.6 Driver IC schematic

These circuits are supplied by	**5V +/- 5% logic voltage**
Each circuit features	**64 open collector transistors**
	64-bit shift register
	64-bit memory register
Each circuit controls	**64 resistor dots on the print head**

The heating element power supply VCH is not connected to the Driver ICs but only to the resistive line of dots itself. The driver ICs are connected via a pattern of high current gold interconnecting traces to the line of resistor dots.
The dot line is of the interdigitated type, in order to maintain the tight definition of the dot geometry and resistance. In such a scheme the heating element power supply VCH forms a 'comb' of traces over which the resistive line of dots is laid. The outputs of the driver ICs form a second comb interdigitated with the first.

4.4.2 Operation of the complete module

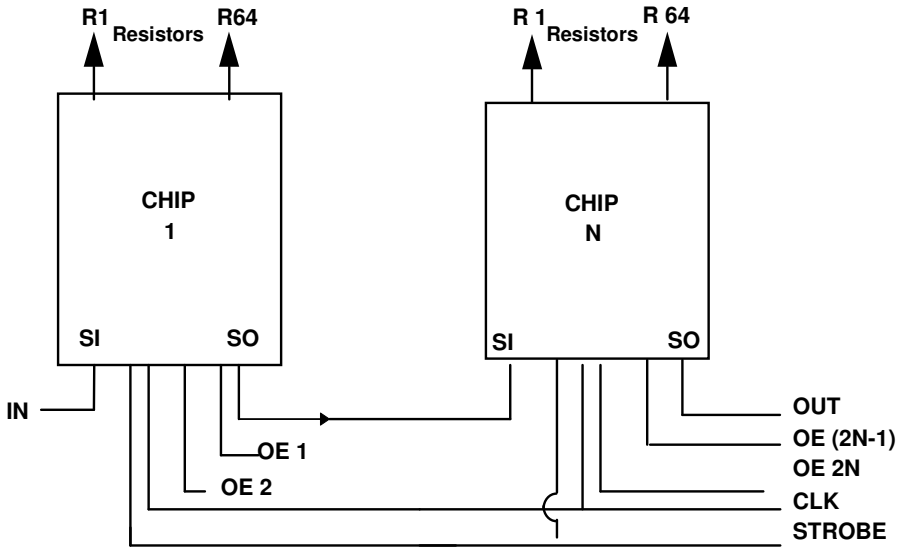


Fig.7

- Data to be printed is clocked into a shift register formed by cascading "n" chips.
- E.g. 448 dot head uses 7 chips with the SO output of chip 1 used as the SI input for chip 2 etc. Respectively, the SO output of chip 2 is used as the SI input for chip 3 etc.

After 448 clocks, the initial piece of data entered corresponds to the last (448th) dot of the line (the R64 output of the 7th chip). The last bit of data entered will correspond to the first dot of the line (R1 of the first chip).

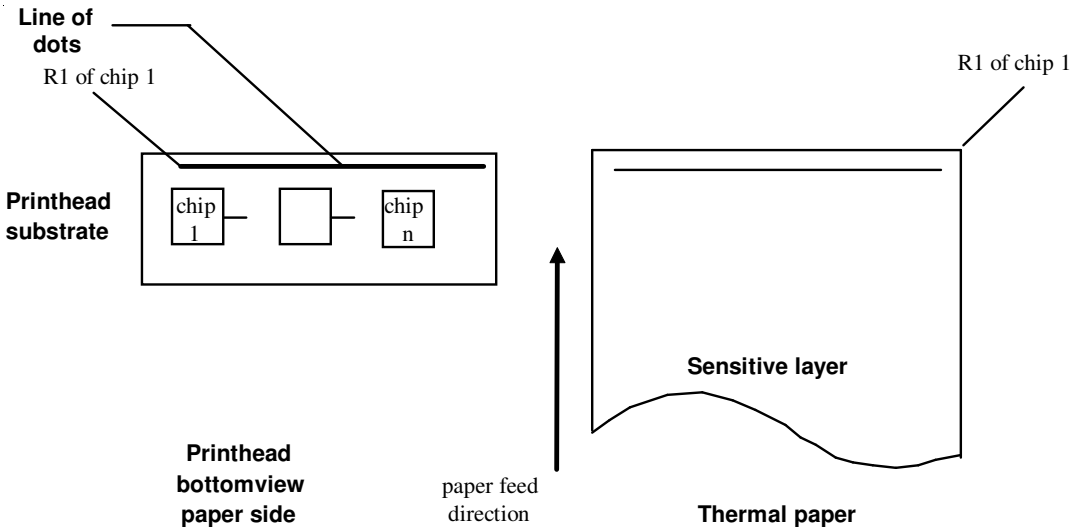


Fig.8 Routing of data to the resistor dots

4.4.3 Electrical specifications of 64-BIT LSI driver

4.4.3.1 General

PARAMETER	MIN	MAX	UNIT
Max. voltage at outputs 1 to 64 (Vdon)		**15.2**	**V**
Max. input voltage		**6.5**	**V**
Max. output current/dot	**50**	**50**	**mA**

4.4.3.2 Other

The specifications given below are given for the following conditions:

- Room temperature
- Logic voltage on chip: 4.5 V < Vdd < 5.5 V
- Clock frequency: 5MHz

Logic Current (5 V)	Conditions	Values	Symb
Current supply	**All high**	**7 mA**	**Idd**
Min. high-level input voltage	**Vdd = 5V**	**0.7Vdd**	**Vih**
Max. low-level input voltage	**Vdd ≤ 5V**	**0.3 Vdd**	**Vil**
Max. high-level input current		**0.5µA**	**Iih**
Max. low-level input current		**0.5µA**	**Iil**
Min. high-level output voltage	**Vdd = 4.5**	**4.45 V**	**Voh**
Max. low-level output voltage	**Vdd = 4.5**	**0.05 V**	**Vol**

4.4.3.3 Timing

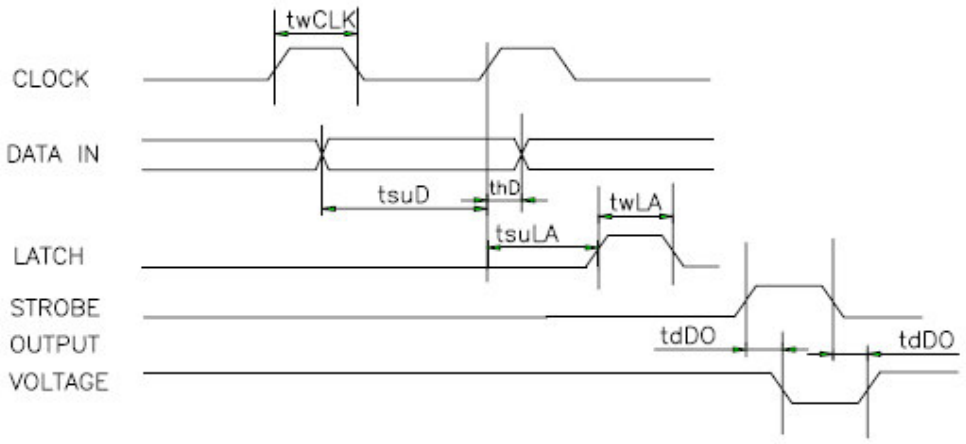


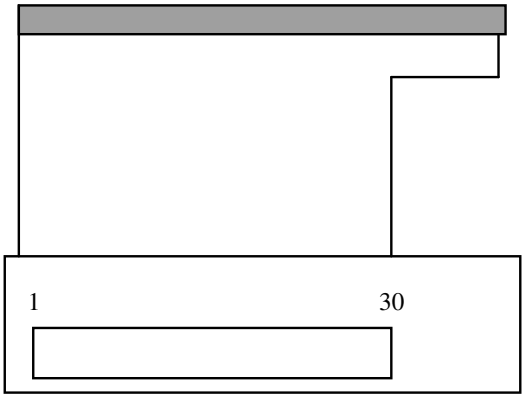
Fig.10 Timing diagram for CM-RMDT

Parameter	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Clock frequency	f_{MAX}	cascade			5.0	MHz
Clock pulse width	tw(T)		70			ns
Data setup time	tsu(D)		40			ns
Data hold time	th(D)		40			ns
Latch setup time	tsu(LA)		100			ns
Latch pulse width	tw(LA)		100			ns
Strobe to driver Output delay time	td(DO)				10.5	µs

4.4.4 Print head Connection

PINOUT OF ZIF 30 CONNECTOR

PIN N°	SIGNAL	PIN N°	SIGNAL
1	Vch	16	GND
2	Vch	17	GND
3	Cutter motor B2	18	GND
4	Cutter motor B1	19	GND
5	Cutter motor A1	20	GND
6	Cutter motor A2	21	Thermistor 1
7	Switch Out	22	Thermistor 2
8	Anode Opto-sensor	23	OE1
9	Collector Opto-sensor	24	Data In
10	Data Out	25	Paper feed motor B2
11	Clock	26	Paper feed motor B1
12	Strobe	27	Paper feed motor A2
13	OE3	28	Paper feed motor A1
14	Vcc	29	Vch
15	OE2	30	Vch



This connector (fitted on your printer) should be connected to your board with a 30 pins flex to another compatible connector.

Compatible connector suppliers and references:

Molex 5597 3951 3304	straight connector
Molex 5597 3951 3303	bent connector
Stocko MZF 9390 60 3030	straight connector
Stocko MZF 8900 60 3030	bent connector

Chip connection for 8 dots/mm print-head (6 chips to connect)

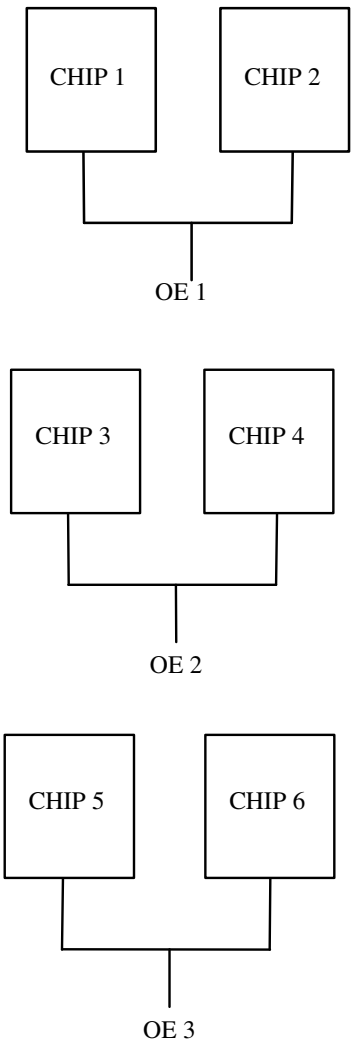


Fig. 12

4.5 Bipolar paper feed motor

An optional bipolar motor is available for paper feed

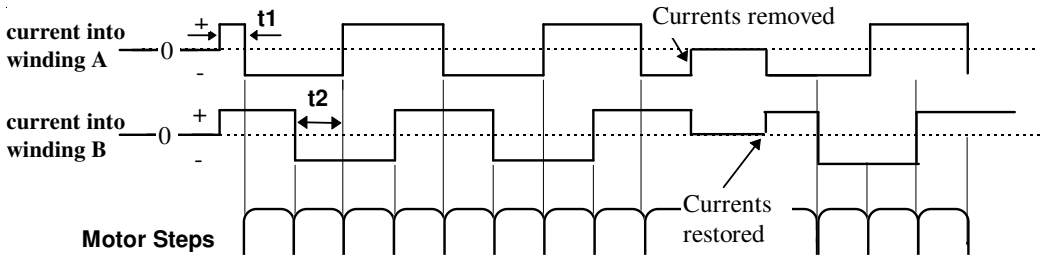
4.5.1 General specification

- Recommended control voltage: 12V
- Coil resistance: 10 Ω ± 10%
- Number of phases: 4
- Step angle: 7° 30'
- Paper feed for one printing line: 1
- Recommended control current: 500 mA (peak)
- Maximum starting frequency: 500 pps

4.5.2 Induction sequence and timing

	BLACK	YELLOW	BROWN	ORANGE
STEP 1	—	—	+	+
STEP 2	+	—	—	+
STEP 3	+	+	—	—
STEP 4	—	+	+	—

Voltage on cable is negative where shown as "-".
Voltage on cable is positive where shown as "+".



There are 4 different conditions for the motor windings:

The sequence is:

$$AB \Rightarrow \bar{A}B \Rightarrow \overline{AB} \Rightarrow A\bar{B} \Rightarrow AB$$

Where

$A\bar{B}$ **stands for "A is positive and B is negative" etc.**

- This electrical sequence corresponds to a sequence of 4 consecutive mechanical positions. The sequence is repeated 12 times for each revolution.

- t1 = 0.4 ms
- t2 = 2 ms

Motor initialization

Once the initial winding currents have been applied they must be maintained for a time t1. Once this time has passed the motor may be operated by changing the winding currents in the usual way.

The same acceleration table can be used for bipolar motor than for unipolar motor (see page 18)

To take-up the play in the gears it is necessary to operate the motor for 16 steps before starting to print.

4.5.3 Paper Motor Acceleration Ramp-Up

Speed = pParamMov->dMinSpeed+(((pParamMov->dMaxSpeed - pParamMov->dMinSpeed)*(i))/((pParamMov->iNbrSteps-1)));

pParamMov->dMinSpeed	50
pParamMov->dMaxSpeed	150
iNbrSteps	17

Steps	Speed (mm/s)
0	50
1	56
2	63
3	69
4	75
5	81
6	88
7	94
8	100
9	106
10	113
11	119
12	125
13	131
14	138
15	144
16	150

4.6 Bipolar cutter motor

4.6.1 Overview

The cutter is mounted to the printer cover and includes parts below:

- Stepping motor
- Cutter drive wheel & rack
- Switch

This cutter can achieve partial or total cuts

4.6.2 General specification

- Coil resistance: 2.5 Ω
- Step angle: 15°
- Number of steps per revolution: 24

4.6.3 Connection

Connected to the PCB

4.6.4 Induction sequence

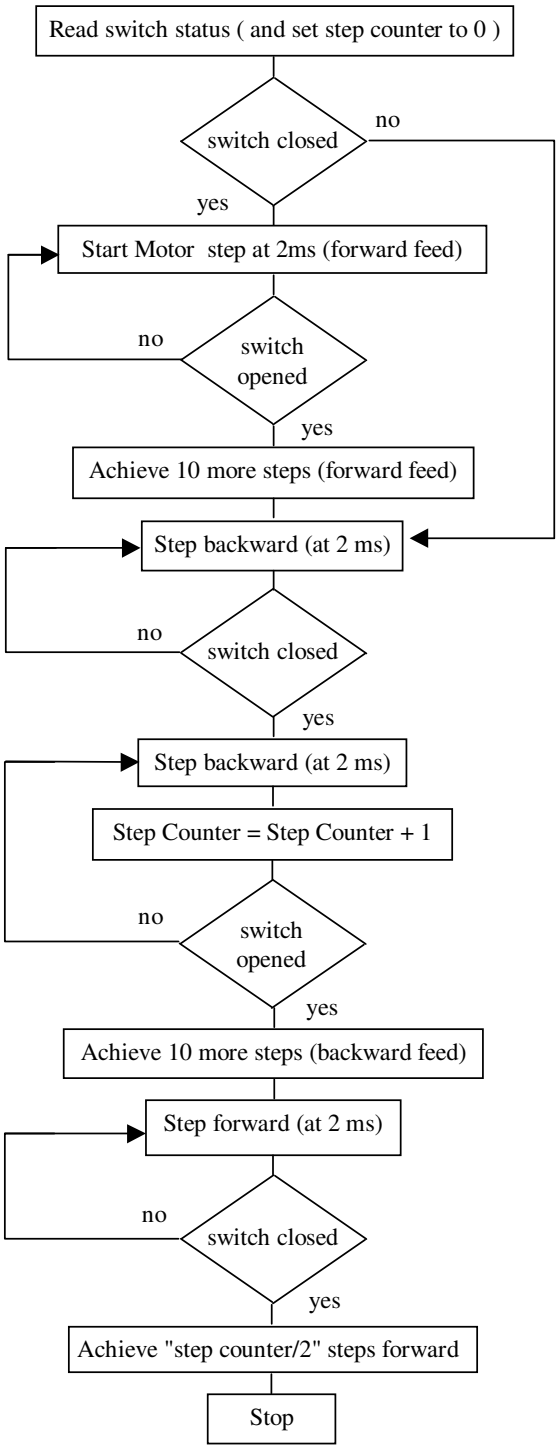
	A1	A2	B1	B2
Step 1	-	+	-	+
Step 2	-	+	+	-
Step 3	+	-	+	-
Step 4	+	-	-	+

4.6.5 Cutter Initialization

The sequence described next page with logic chart allows the cutter to be well positioned when the system (mechanism & controller board) is powered on (or reset).

Notes:
- The logic chart is designed to place the cutter in the middle of the "closed switch area".
- When ten additional steps in are achieved after a switch status reading, this avoids reading mistake due to switch bounce.

Cutter initialization logic chart:



4.6.6 Cutter Motor Acceleration Ramp-Up

The cutter can be started with a motor step time of 2 ms, and then the speed can be increased by reducing this cycle time up to 1 ms following the curve given here after.

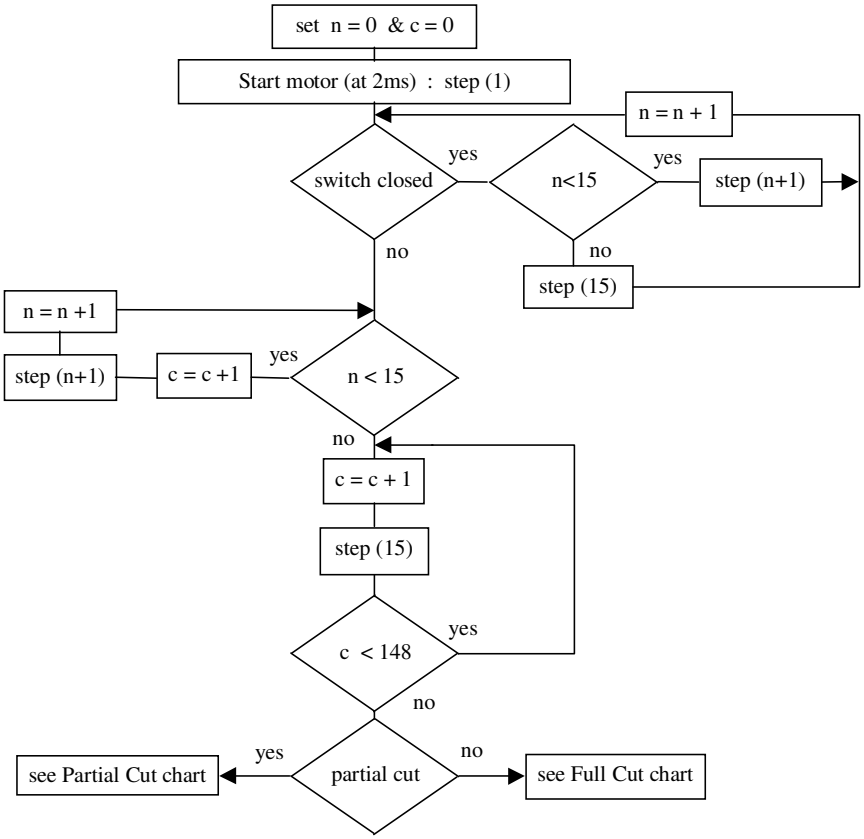
Step	1	2	3	4	5	6	7	8
Time (µs)	2000	2000	2000	2000	2000	1800	1660	1530

Step	9	10	11	12	13	14	15
Time (µs)	1420	1330	1250	1170	1110	1050	1000

Notes:
- This curve uses 2000µs on the first 5 steps, this does not correspond to acceleration but to a routine applied in the next logic chart (where "step (n)" means one motor step is achieved with the step time given above).
- This acceleration ramp up can be used either for forward or backward blade movement.

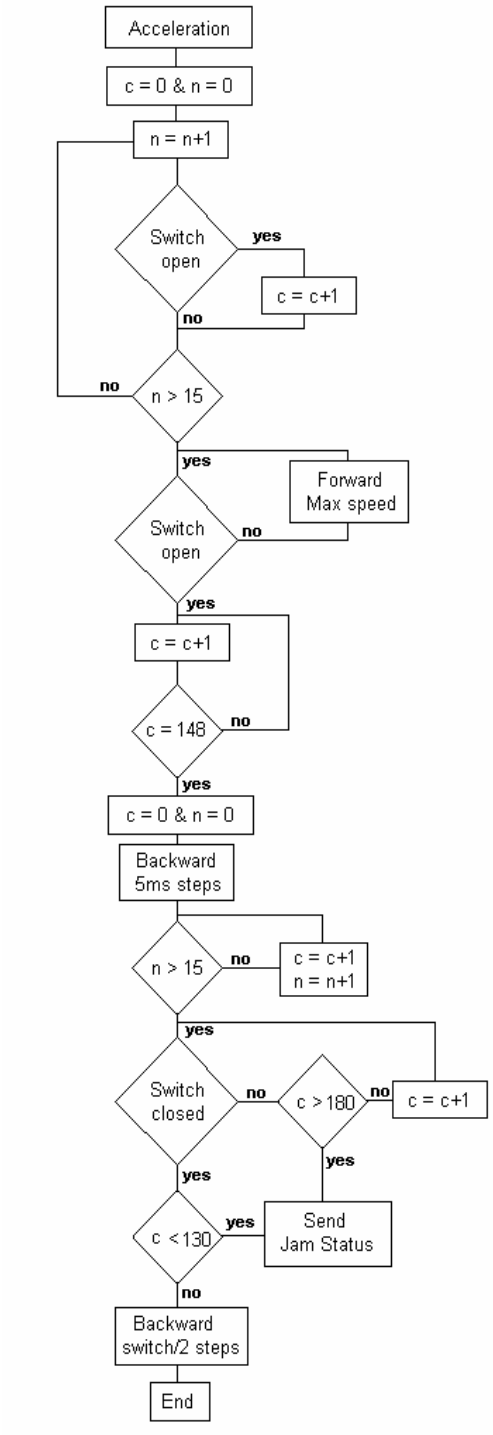
4.6.7 Cutter Driving Chart

This first chart allows starting the cutter with the acceleration ramp up previously given (for motor step time).

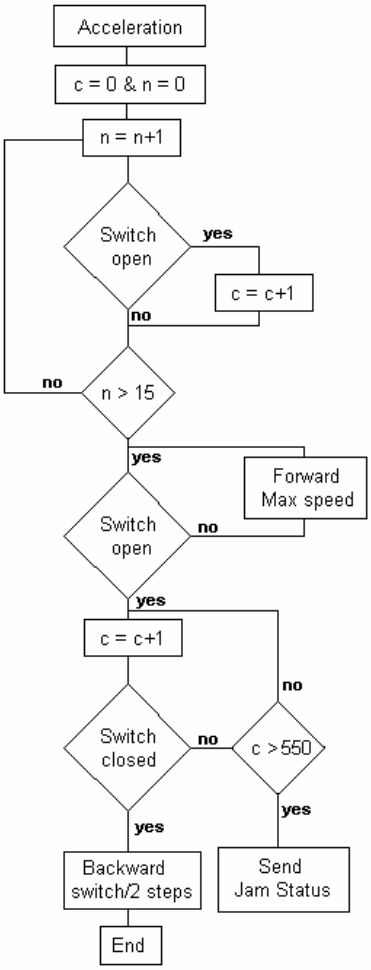


The chart changes now here depending on the type of cut required: partial or full cut.

PARTIAL CUT



FULL CUT



n is the number of steps for the cutter motor acceleration.

c is the number of steps for the total cycle of partial or full cut.

4.7 Cutter micro-switch specifications

4.7.1 General specification

Reference	**DB3A-A1BA Switch Cherry**
Contact resistance	**50 mΩ Maximum**
Maximum Current	**0,1A - 125 V AC (UL V0)**
Maximum Rating	**2 000 000 Open-Close cycles**

4.7.2 Connection

Connected to the PCB with cutter motor and integrated to the flexible

Wires	Contact Status	'Guillotine' blade
White / White	Open	Closed
	Closed	Open

4.8 Opto-sensor specification

4.8.1 Electrical characteristics

Absolute Maximum ratings

	SYMBOL	RATING	UNIT
LED			
Continuous Forward Current	**If**	**50**	**mA**
Pulsed forward current *	**I_{FP}**	**1**	**A**
Reverse voltage	**V_R**	**5**	**V**
Max. Power Dissipation at 25°C max	**P**	**75**	**mW**
PHOTO-TRANSISTOR			
Collector Emitter Voltage	**V_{CEO}**	**30**	**V**
Collector Current	**IC**	**20**	**mA**
Collector Dissipation at 25°C max	**PC**	**50**	**Mw**

*** (Time On, Time Off) T On = 100µs, T On + T Off = 10 ms**

***Note*:** Driving the sensor with pulse current allows using higher current to improve paper detection.

Input/Output Conditions

	SYMBOL	CONDITIONS	Min.	TYP.	Max.	UNIT
LED						
Forward voltage	**VF**	**IF=10 mA**			**1.3**	**V**
Reverse current	**IR**	**VR=5v**			**10**	**µA**
TRANSFER CHARAC.						
Collector dark current	**I_{CE0}**	**V_{CE}=10V**			**200**	**nA**
Light Current	**I_L**	**V_{CE}= 5V, I_F=10mA**	**90**			**µA**
Leakage Current	**ICE0D**	**V_{CE}= 5V, I_F=10mA**			**200**	**nA**
Rise time	**tr**	**V_{CE}= 2V, I_C=100µA**		**30**		**µs**
Fall time	**tf**	**RL= 1kΩ**		**25**		**µs**
Peak wave length	**λp**			**940**		**nm**

4.8.2 Connection

Connected to the PCB, the opto-sensor is then clipped in front or bottom position.

4.8.3 External circuit

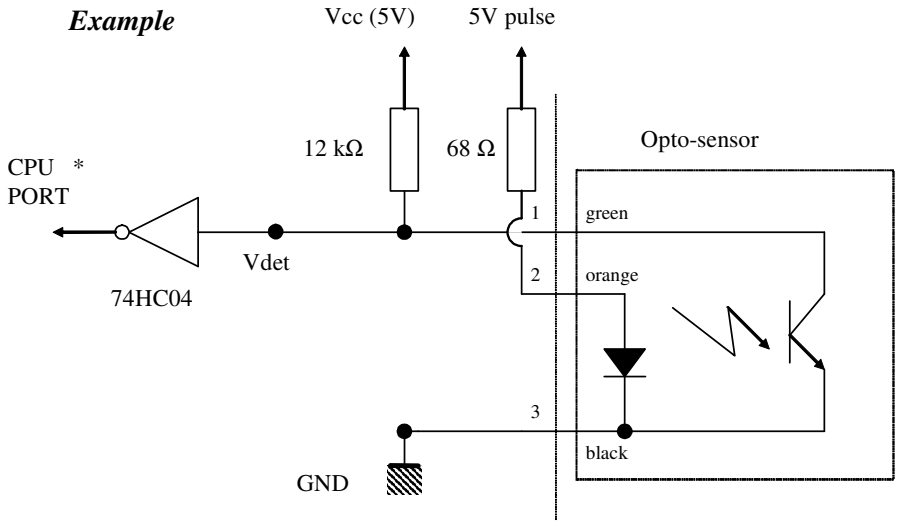


Fig. 14

***Note*:** When paper is detected Vdet < 2.25V.

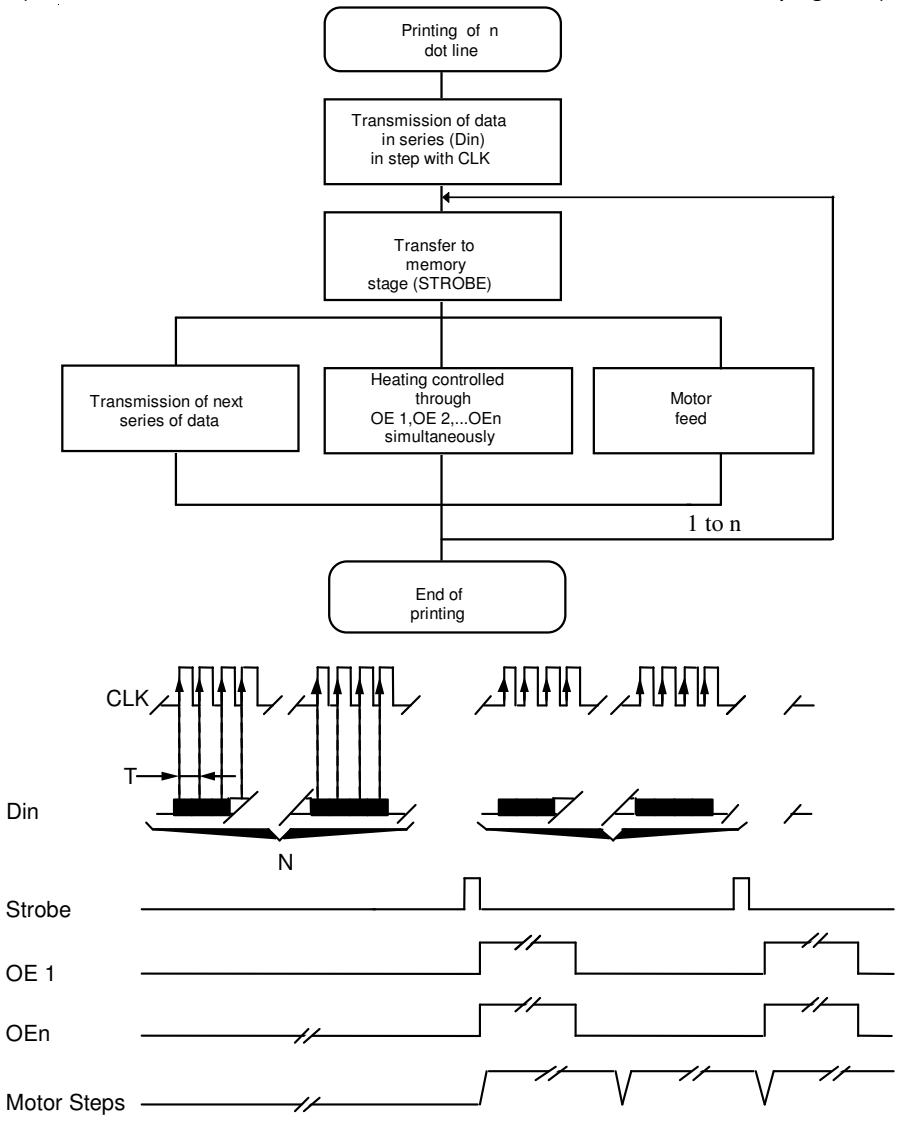
* The rise time and fall time depend on the voltage and current driving conditions. In the example above we recommend to measure the sensor response 300 µs after the current leading edge of the pulse (or current establishment) in the sensor LED.

5 PRINTER CONTROL TECHNIQUES

For printer control techniques in order to operate the printer, We depict hereafter three possible modes.

5.1 Mode 1

The paper feeds itself automatically during the heating cycle thereby permitting a high speed to be achieved. (in this mode, it is recommended to use historical control, see page 35)

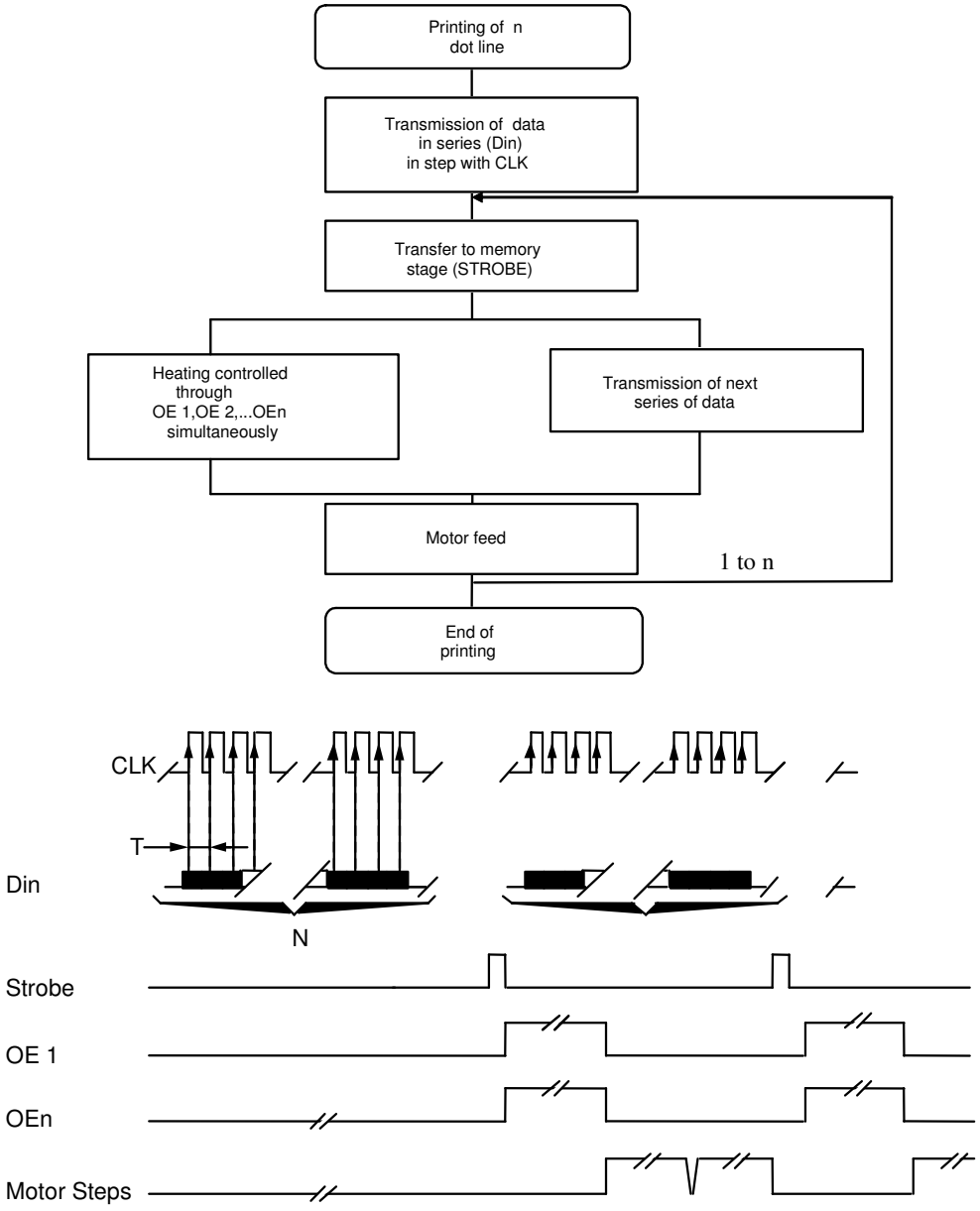


T : 4MHz for CM-RMDG

Fig. 15 Timing diagram for mode 1

5.2 Mode 2

The paper feed occurs after the heating cycle giving high quality printing.

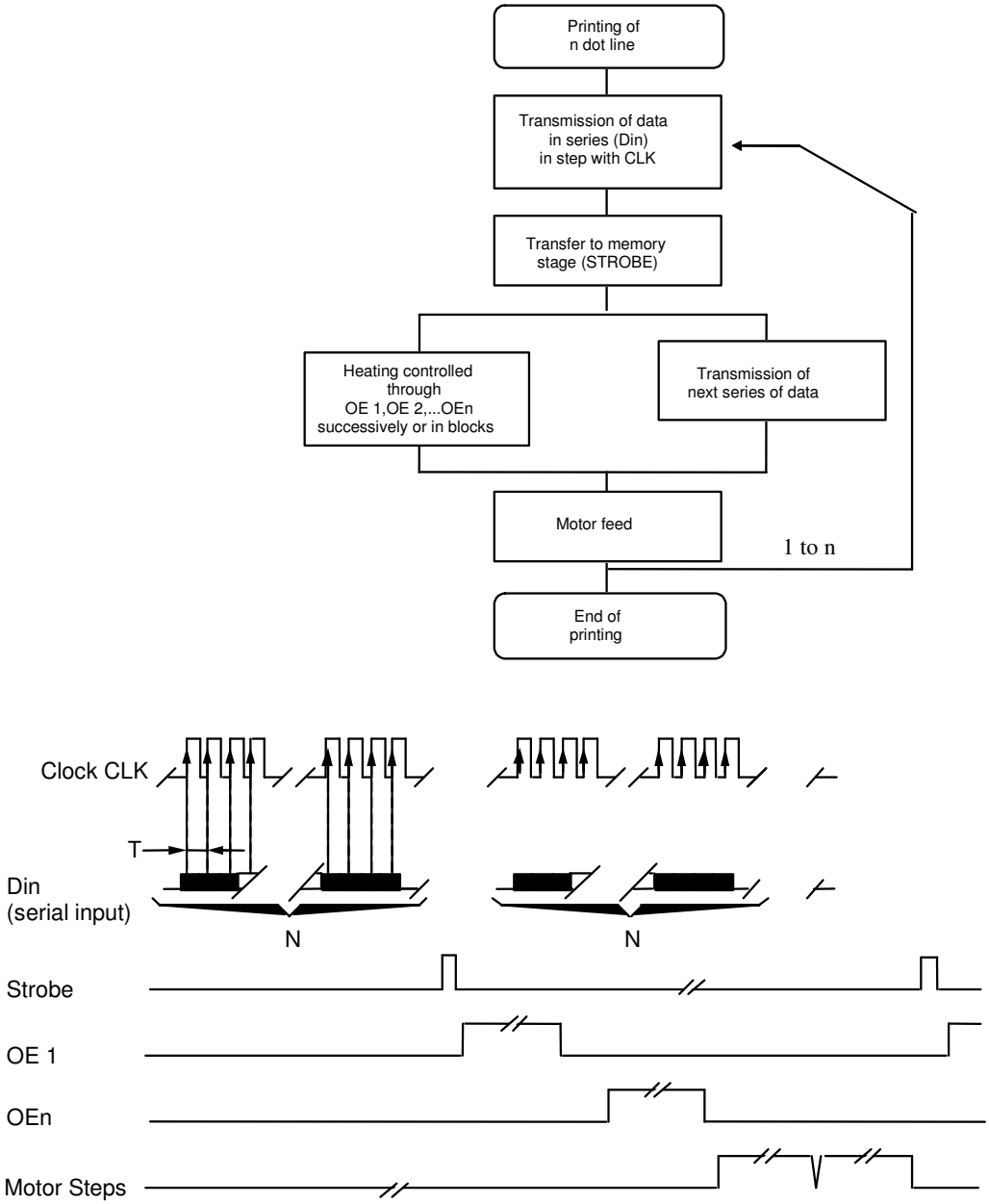


T : 4MHz for CM-RMDG

Fig. 16 Timing diagram for mode 2

5.3 Mode 3

This mode is used in conditions where there is a limit of electrical current. The dot line is printed in stages heating only a portion of the line at a time, effectively giving reduced consumption.



T : Clock frequency 4MHz for CM-RMDG

Fig. 17 Timing diagram for mode 3

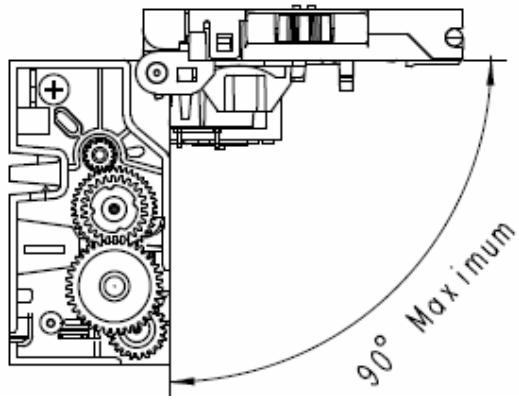
6 RECOMMENDATIONS

6.1 Mechanical recommendations

Never apply mechanical stress to the printer; this could result in misalignment and thus degradation of the print quality.

The thermal print head must have 1 degree of freedom. Never hinder the print head from pivoting on its axis.

Opening the mechanism (by opening the cutter cover) is only required in case of paper jams to reach the thermal print head, or in order to clean the mechanism, or for an easier cutter replacement (maintenance task).
Never open the cover beyond its limit stop (maximum angle: 90°), otherwise the plastic part will break.



Once the mechanism had been open and is to be close, check manually that the remaining paper is positioned through the blades of the cutter (that is through the paper exit slot) otherwise, it will lead to a paper jam.

6.2 Housing design recommendations

Forecast space for paper guide to use one of the two possible paper inlets (or both)

When the front paper inlet is used, we recommend an additional paper guiding to facilitate correct paper introduction.

See the fixation position, make sure it is easy enough to release printer, this operation is necessary for easy maintenance (change of print head for example)

Space to open cover: the cover (which contains the cutter) is strongly clipped, it is necessary to leave enough place to catch it in order to open it.

6.3 Energizing & de-energizing printer

When energizing the thermal print head (Vcc, 5 V) it is important to apply all the logic signals within 10 ms (particularly to de-energize all the OEs).

If the line of dots (Vch, 12 V) is supplied before the control logic, resistor dots may be destroyed. Because the control logic has a random state, resistors might be heated for a longer period than the specified maximum, burning out the heated resistor.

To avoid this, we recommend applying the heating voltage (Vch) after the logic supply voltage (Vcc, 5V).

The same precaution should be taken when shutting down. The supply voltage Vch must be switched off before the logic supply voltage Vcc. Care should be taken to allow enough time for residual capacitive charge to dissipate.

6.4 Printing recommendations

- In order to avoid excessive noise from the stepper motor, avoid using it at the following frequencies: between 150 and 250 pps (for better printing quality, avoid fast speed variations).
- To avoid the paper feed motor temperature rise, use a time ratio of 1 "on" with "4 "off.

Examples: 1 seconds "On" followed by 3 seconds "Off", 10 seconds "On" followed by 30 seconds "Off".

6.5 Recommendations for paper

- Use a paper reference recommended by AXIOHM. Poor quality paper may affect the print head life and the printer performances.

Max roll diameter (mm) *	
Paper Roll in Bucket max diameter (mm)	**120**
Paper Roll on Spindle max diameter (mm)	**200**

* At max print speed: 150 mm/s

- Above 120mm paper roll diameter a paper dampening system is required to reduce shock of roll inertia.
- Leave the paper stock spool free to turn.
- The printer should not operate without paper as this will damage the surface of the platen.

6.6 General

- Ensure that there is adequate air circulation around the print head support/heat sink as poor ventilation of the print head can degrade the print quality.
- Never open the cover whilst the cutter is operating.
- Never introduce tools inside the printer, wires could be de-soldered or short circuited.
- It is very important that the print head support/heat sink is connected to the customer appliance chassis (see p16 pin out connection GND).
- Ensure that the cutter blades are in the correct position before use in order to ensure that they do not deteriorate.
- When continuous printing is performed, the supply energy should be reduced so that the head temperature monitored through the thermistor will remain below the maximum temperature.
- When setting 'power on / power off', strobe (STR) shall be on 'disable'.
- Heat elements and IC's shall be anti-electrostatic in order to prevent electrostatic destruction. Do not touch the connector pins with fingers.
- Make sure no foreign particles roll on the head surface, this would cause damage.
- If condensation occurs, do not switch on the printer until it has disappeared.

6.7 Cleaning recommendations

The CM/RMDG mechanisms are high reliable units which require very little maintenance but may benefit from cleaning as detailed below.
Depending on the environment in which the printer is used, the printer can accumulate dust. Therefore it is necessary to clean it periodically in order to maintain a good print quality. The cleaning period is dependant on the environment and the usage of the printer, but the print head should be cleaned at least once a year or up to one month in heavy duty applications. The print head should always be cleaned immediately if the print becomes visibly fainter due to its contamination.

Cleaning Instructions:

- Switch off printer. **Never clean the head immediately after printing, the head may be hot**.
- Open the printer cover and remove the paper from its slot.
- Clean the heating dots of the head with a cotton swab containing a solvent alcohol (ethanol, methanol, or IPA) but **do not touch the print head with your fingers!**
- Allow the solvent to dry.
- Reload the paper and close cover.

N.B**:** AXIOHM is able to provide cleaning kits **Ref: CK60000A**

6.8 Special recommendation for cutter

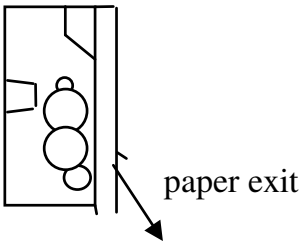
Mechanical stress should not be applied to the cutter cover; it would lead to a blade movement perturbation.

Make sure the ground is connected. Ground must stay connected while operating and manipulating the cutter cover.

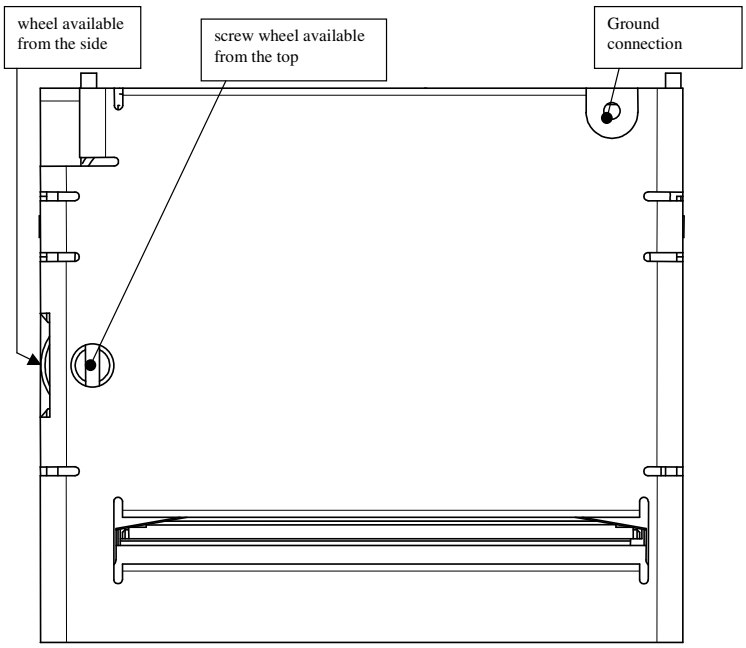
Do not keep the cutter motor phase "on" while the cutter is not operating (this would also lead to an increasing motor temperature).

To avoid paper jam, it is recommended to feed 2 mm of paper (16 motor steps) after cutting.

A vertical position, as shown on next drawing, is better for paper dust elimination.



To release blades in case of jam, use the wheel shown on next drawing:



7 APPENDICES

7.1 APPENDIX 1: Thermistor specifications

GENERAL CHARACTERISTICS	
Maximum operating temperatures	**-20° C to + 70° C**
Rated resistance at 25° C	**Rn (see table of values)**
Tolerance for Rn	**5 %**
Thermal dissipation factor	**_ = 5 mW/°C**
Thermistor time constant/dot line	**t = 30 sec**
Resistance value as a function of temperature (see curves)	

This thermistor has a rated value of 30K kΩ. Its resistance variation can be expressed as follows:

R = Rn exp B $(\frac{1}{T}-\frac{1}{Tn})$ **where T is in Kelvin degrees (°K)**

B const = 3950 ° K

Rn = reference value at temperature Tn (295° K)

The main specifications of the thermistor are listed in the following pages.

NTC thermistor, rectangular size (IEC 12.05), silver palladium metallic coating.

APPENDIX 1: THERMISTOR SPECIFICATIONS (Contd.)

RESISTANCE/TEMPERATURE VARIATION for CM-RMxx

R_{25} = 30KΩ±5%, B $_{CONST}$= 3950kelvin±3%, $R = R_{25}e^{B(1/T-1/T_{25})}$

Temperature (° C)	Thermistor Resistance (R)		
	Min .(KΩ)	Typ. (KΩ)	Max. (KΩ)
-40.0	717	843	989
-35.0	535	623	723
-30.0	405	466	535
-25.0	308	352	400
-20.0	238	269	303
-15.0	185	208	232
-10.0	145	161	178
-5.0	113	124	137
0.0	88.7	96.8	105
5.0	69.9	75.7	81.7
10.0	55.4	59.5	63.8
15.0	44.1	47.1	50.1
20.0	35.4	37.5	39.6
25.0	28.5	30.0	31.5
30.0	22.8	24.2	25.5
35.0	18.3	19.6	20.8
40.0	14.9	15.9	17.1
45.0	12.1	13.1	14.1
50.0	9.92	10.8	11.7
55.0	8.16	8.91	9.7
60.0	6.76	7.41	8.12
65.0	5.62	6.2	6.83
70.0	4.7	5.21	5.77
75.0	3.95	4.4	4.9
80.0	3.34	3.74	4.18

7.2 APPENDIX 3: Heating time and historical control

The heating time tables are presented on next pages

The motor cycle time for one dot line is given in the second top line of the table; it is the time for one (or two) motor step(s).
The column 3 (indicated with: speed <xxx mm/s and motor cycle time > xxx ms) gives the required heating time, giving the necessary energy to obtain an optical density of 1.2.

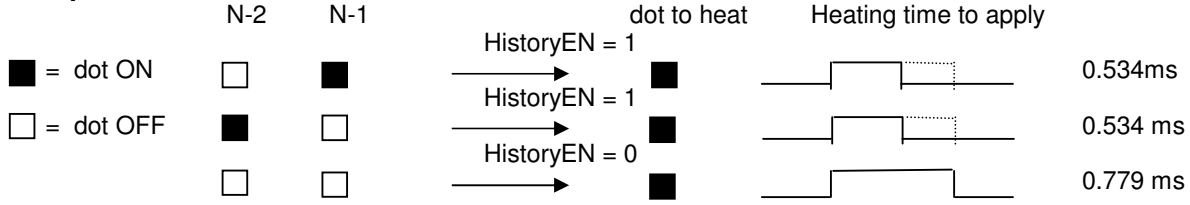
How to use tables?

Heating time can be controlled either with or without historical control.

- Without historical control: apply the indicated heating time given as a function of speed, voltage and temperature. At high speed, printing quality for isolated dots might be affected with this method.

Example: at 100 mm/s, 30°C and 12 volts, heating time = 0.534 ms
- With historical control: apply the indicated heating time (function of speed, voltage and temperature) when the dot has been heated on the previous sub line, and the time from column 3 when it has not. This method gives the best printing quality.

Example: at 100 mm/s, 30°C and 12 volts:



Heating time table

Density vs Energy	
Voltage	12 Volts
Temperature	24 °C
Speed	158,2 mm/s
Paper	3104208
Eo saturation	0,222 mJ
Tch (saturation heating time)	0,451 ms
Température statique	80 °C

(cf Density Sheet)

At Nominal Speed & Nominal Temperature

$$t_1 = \frac{R_{mean}}{V'^2} \times E_0$$

Heating Time vs Speed	
Voltage	12 Volts
Temperature	24 °C
Paper	3104208
Coeff "a"	0,5287
Coeff "b"	1,1246

At Nominal Voltage & Nominal Temperature

$$t_2 = t_1 \times (a \times Log(tm) + b)$$

t_m = Time for motor step (ms)

Heating Time vs Temperature	
Voltage	12 Volts
Speed	158,2 mm/s
Paper	3104208
Coeff "c"	-0,00900000
Coeff "d"	1,21600000
Coeff "g"	-0,00000284
Coeff "h"	0,00017290
Coeff "i"	-0,01057871
Coeff "j"	1,19354839

At Nominal Speed & Nominal Voltage

For linear modelisation

$$t_3 = t_2 \times (cT + d)$$

For polynomial modelisation

$$t_3 = t_2 \times (g \times T^3 + hT^2 \times iT + J)$$

Heating Time vs Voltage	
Temperature	24 °C
Speed	158,2 mm/s
Paper	3104208
Coeff "e"	0,7821
Coeff "f"	2,6320

At nominal Temperature & Speed

$$V' = eV + f$$

Axiohm
Innovating for you

Calculated Values For
C56-300AX with Paper 3104208 (Jujo AF50KS-E3)

Voltage (V) Real	Temperature (°C)	Speed (mm/s)				R=	292,6 Ohms	
		< 34 mm/s	50 mm/s	70 mm/s	100 mm/s	130 mm/s	146 mm/s	150 mm/s
Temps moteur pour un pas		3,680 ms	2,500 ms	1,790 ms	1,250 ms	0,960 ms	0,860 ms	0,830 ms
Temps moteur pour une sous li		3,680 ms	2,500 ms	1,790 ms	1,250 ms	0,960 ms	0,860 ms	0,830 ms
10,00 Volts	0 °C	1,287 ms	1,142 ms	1,016 ms	<None>	<None>	<None>	<None>
10,00 Volts	10 °C	1,188 ms	1,054 ms	0,939 ms	0,814 ms	<None>	<None>	<None>
10,00 Volts	20 °C	1,109 ms	0,984 ms	0,876 ms	0,760 ms	<None>	<None>	<None>
10,00 Volts	25 °C	1,070 ms	0,950 ms	0,845 ms	0,733 ms	<None>	<None>	<None>
10,00 Volts	30 °C	1,030 ms	0,914 ms	0,813 ms	0,706 ms	<None>	<None>	<None>
10,00 Volts	40 °C	0,933 ms	0,828 ms	0,737 ms	0,639 ms	0,567 ms	<None>	<None>
10,00 Volts	50 °C	0,800 ms	0,710 ms	0,632 ms	0,548 ms	0,487 ms	0,461 ms	0,453 ms
11,00 Volts	0 °C	1,114 ms	0,988 ms	0,880 ms	0,763 ms	<None>	<None>	<None>
11,00 Volts	10 °C	1,029 ms	0,913 ms	0,812 ms	0,705 ms	<None>	<None>	<None>
11,00 Volts	20 °C	0,960 ms	0,852 ms	0,758 ms	0,658 ms	0,584 ms	<None>	<None>
11,00 Volts	25 °C	0,926 ms	0,822 ms	0,732 ms	0,635 ms	0,564 ms	<None>	<None>
11,00 Volts	30 °C	0,891 ms	0,791 ms	0,704 ms	0,611 ms	0,542 ms	<None>	<None>
11,00 Volts	40 °C	0,808 ms	0,717 ms	0,638 ms	0,553 ms	0,491 ms	0,465 ms	0,457 ms
11,00 Volts	50 °C	0,692 ms	0,614 ms	0,547 ms	0,474 ms	0,421 ms	0,399 ms	0,392 ms
12,00 Volts	5 °C	0,934 ms	0,828 ms	0,737 ms	0,640 ms	0,568 ms	<None>	<None>
12,00 Volts	10 °C	0,899 ms	0,798 ms	0,710 ms	0,616 ms	0,547 ms	<None>	<None>
12,00 Volts	23 °C	0,822 ms	0,729 ms	0,649 ms	0,563 ms	0,500 ms	0,473 ms	0,465 ms
12,00 Volts	25 °C	**0,810 ms**	0,719 ms	0,640 ms	0,555 ms	0,493 ms	0,467 ms	0,458 ms
12,00 Volts	30 °C	0,779 ms	0,691 ms	0,615 ms	0,534 ms	0,474 ms	0,449 ms	0,441 ms
12,00 Volts	40 °C	0,706 ms	0,626 ms	0,558 ms	0,484 ms	0,429 ms	0,407 ms	0,399 ms
12,00 Volts	50 °C	0,605 ms	0,537 ms	0,478 ms	0,415 ms	0,368 ms	0,349 ms	0,342 ms
13,00 Volts	0 °C	0,858 ms	0,761 ms	0,678 ms	0,588 ms	0,522 ms	0,495 ms	<None>
13,00 Volts	10 °C	0,793 ms	0,703 ms	0,626 ms	0,543 ms	0,482 ms	0,457 ms	0,448 ms
13,00 Volts	20 °C	0,740 ms	0,656 ms	0,584 ms	0,507 ms	0,450 ms	0,426 ms	0,418 ms
13,00 Volts	25 °C	0,714 ms	0,633 ms	0,564 ms	0,489 ms	0,434 ms	0,411 ms	0,404 ms
13,00 Volts	30 °C	0,687 ms	0,609 ms	0,543 ms	0,471 ms	0,418 ms	0,396 ms	0,389 ms
13,00 Volts	40 °C	0,622 ms	0,552 ms	0,492 ms	0,426 ms	0,378 ms	0,359 ms	0,352 ms
13,00 Volts	50 °C	0,534 ms	0,473 ms	0,421 ms	0,366 ms	0,325 ms	0,307 ms	0,302 ms
14,00 Volts	0 °C	0,762 ms	0,676 ms	0,602 ms	0,522 ms	0,464 ms	0,439 ms	0,431 ms
14,00 Volts	10 °C	0,704 ms	0,625 ms	0,556 ms	0,482 ms	0,428 ms	0,406 ms	0,398 ms
14,00 Volts	20 °C	0,657 ms	0,583 ms	0,519 ms	0,450 ms	0,399 ms	0,378 ms	0,372 ms
14,00 Volts	25 °C	0,634 ms	0,563 ms	0,501 ms	0,434 ms	0,386 ms	0,365 ms	0,359 ms
14,00 Volts	30 °C	0,610 ms	0,541 ms	0,482 ms	0,418 ms	0,371 ms	0,351 ms	0,345 ms
14,00 Volts	40 °C	0,553 ms	0,490 ms	0,437 ms	0,379 ms	0,336 ms	0,318 ms	0,313 ms
14,00 Volts	50 °C	0,474 ms	0,420 ms	0,374 ms	0,325 ms	0,288 ms	0,273 ms	0,268 ms

Base heating time

n,nnn *Warning base heating time > line time for this speed*